

Abstract: **Feasibility Study of VIIRS Detector-Level Spectral Response SDR Processing and Calibration**

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Modern satellite radiometers have a large number of detectors. For example, VIIRS has 16 and 32 detectors for the M-band and I-band, respectively, while GOES-R ABI and Himawari AHI have a few hundred detectors for each band. Since each detector has its own relative spectral response (RSR) and they are not identical, ideally, Sensor Data Record (SDR) or level 1B data should be generated for each detector as if it is an independent detector. However, this is computationally complex and expensive, and the current SDR data is generated based on the band-averaged RSR, treating multiple detectors as one average virtual detector, at the expense of accuracy. We found that the detector level RSR difference does impact VIIRS SDRs in both thermal emissive bands (TEB) and reflective solar bands (RSB). Atmospheric dependencies in detector level top of atmosphere reflectance and brightness temperature differences were observed in the NOAA operational SDRs, especially over tropical oceans. Striping is also related to the difference between band-averaged and detector-level RSR. Therefore, if the detector level RSR in SDR processing and calibration is used, the SDR products will more accurately reflect real detector measurements.

The purpose of this study is to investigate the feasibility to use detector level RSR in VIIRS SDR processing and calibration. The current operational VIIRS SDR algorithm will be modified. The formats of several calibration look-up-tables (LUT), as well as their contents, also need to be changed to support detector-level RSRs and other processing parameters. The modified calibration code and LUTs will be used to generate sample SDR data over typical scenes. The impacts of detector-level RSR on VIIRS RSB and TEB SDRs will be quantified by comparing the new SDRs with those produced by the NOAA operational processing. The influence of detector level RSR on RSB and TEB striping patterns will also be studied.